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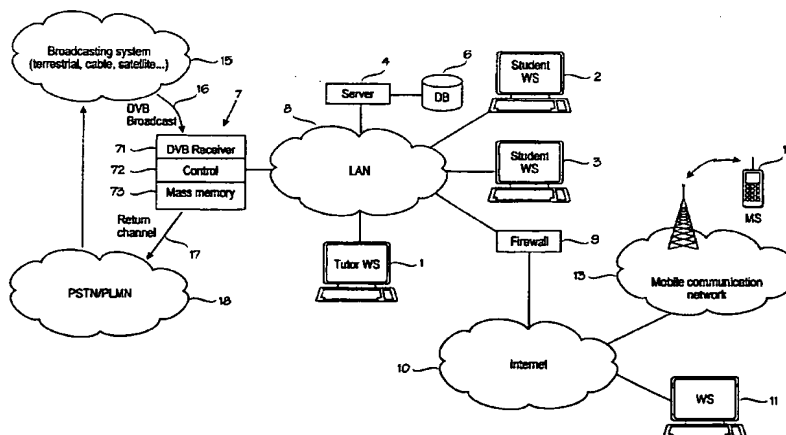
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[Continued on next page]

(54) Title: A NETWORKED LEARNING SYSTEM



(57) Abstract: A networked learning system comprises a tutor workstation (1), student workstations (2,3), and a local area network (8) interconnecting the tutor workstation and the student workstations. The networked learning system is provided with a receiver unit (7) receiving digital television broadcast over a television broadcast system (15) and enabling delivery and storage of a selected digital content from the digital television broadcast in a suitable digital format in a local area network of the networked learning system. The tutor workstation (1) is provided with a program tool which allows a tutor or teacher to schedule, via the local area network, the receiver unit (7) to receive and store a selected digital content from the television broadcast. The workstation (1) is further provided with a program tool for selecting and processing appropriate digital content to be handed out as learning content to end-users (students) by the teacher. The processed content is stored in a learning material database (6) to be used for learning and teaching purposes by the tutor and student workstations.



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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

A networked learning system

Field of the Invention

The present invention relates to networked teaching or learning systems.

5 Background of the Invention

Presently computer-aided teaching and learning has become more and more popular. In the simplest form of computer-aided learning, the student is independently studying with learning software run on a personal computer (PC) or on a network server. There is much learning and educational material available as software products (e.g. CD ROMs) from publishing
10 houses and other content providers. Also in the Internet there is a huge amount of material suitable for learning sessions. The publishing houses even provide Internet web sites, called learning portals herein, which can be accessed by the students over the Internet. Analog material in the form of audio and videotapes disappears from shelves and is being digitized and stored in a
15 systematic manner on powerful media servers.

In a classroom environment, a teacher is typically teaching a group of students each having a workstation networked to the teacher's workstation. Present networking techniques, such as local area networks (LAN), virtual private networks (VPN), and the Internet enable also "virtual" classrooms wherein
20 the students and the teacher may be located in different physical locations. Self-access centres are being created allowing the learners to study at their own pace and in their own time.

However, there is still a demand for new digital learning material, and especially for a new economical and flexible method and system for providing and processing such digital learning material in a networked learning
25 system.

Summary of the invention

An object of the invention is to provide new technical tools for providing digital learning material for networked computer-aided learning.
30

The object of the invention is achieved by a networked learning system, a method, a computer program, a computer program product, and a receiver device which are characterized by what is stated in the independent

claims. The preferred embodiments of the invention are disclosed in the dependent claims.

In the present invention, a networked learning system is provided with a receiver means receiving digital television broadcast over a television broadcast system and enabling delivery and storage of a selected digital content from the digital television broadcast in a suitable digital format in a local area network of the networked learning system. A tutor workstation in the networked learning system is provided with a program tool which allows a tutor or teacher to schedule via the local area network the receiver means to receive and store a selected digital content from the television broadcast. The workstation is further provided with a program tool for a pedagogical mediator to select and process appropriate digital content to be handed out as learning content to end-users (students) by the pedagogue (teacher). The processed content is stored in a learning material database of the networked learning system to be used for learning and teaching purposes by the tutor and student workstations. In a preferred embodiment of the invention, the processing of the content comprises categorizing the content in such a way that users can easily find the appropriate content at the right time needed. The processing preferably comprises creating metadata describing the digital content. The processing may further comprise linking the digital content together with any other content to build portfolios for learning activities.

Thus, the present invention integrates digital television broadcasts as a new source of learning material into a networked learning system. The receiver functionality is an integrated part of the system and provides automated reception and storage of a desired digital content from a television broadcast. The reception is scheduled from a tutor workstation with tools which are an integral part of the other tools provided for the tutor in the learning system. Similarly, the tutor is able to further process the digital content by means of integrated tools. Thus, the tutor is able to use digital content obtained from digital television broadcasts as learning material in a similar manner from as other content obtained from the Internet or CD ROMs, for example. All the extra hardware and manual operations related to the conventional recording by videocassette recorders are avoided due to the automated reception and delivery of the content. The same television reception hardware and functionality can be shared by multiple workstations in the local area network. The invention further makes the digital television broadcast a more attractive

channel for the content providers, such as publishing houses, for delivery of learning material to customers, such as schools. It is for example possible to use the high capacity transmission channel of the broadcast system for delivering targeted content material to individual or small groups of customers during night time, when other programs are not broadcasted. The digital material is not restricted to video programs but it may include any digital content, such as digital audio, text, graphics, etc.

Brief description of the drawings

In the following the invention will be described in greater detail by means of preferred embodiments with reference to the attached drawing, in which

Figure 1 illustrates an example of network architecture of a network learning system according to the present invention.

Preferred embodiments of the invention

Referring to Figure 1, a networked computer-aided learning system includes a number of workstations 1, 2 and 3, and a server 4 interconnected by a data network 8, i.e. the basic configuration is similar to any data network suitable for interconnecting computers. In the illustrated embodiment of the invention, the data network 8 is a local area network LAN, e.g. an IP network (Internet Protocol). The LAN 8 is typically a private network of a company or an institution, such as a school, a university, or any other educational institution. It should be appreciated that the LAN may consist of several interconnected network segments which may be located in different locations apart from each other. The LAN 8 may also be a wireless LAN (WLAN). Also a virtual private network (VPN) can be used in the LAN 8. Further, although the most typical use of the invention is in a classroom-type learning environment, some of the workstations can also be located in remote locations, different countries or in different continents. In Figure 1, for example, the LAN 8 is connected via a firewall 9 to the Internet 10 and further to other communications networks, such as a mobile communications network 13. Thus, also a workstation 11 connected to the Internet, or the mobile station MS 12 connected to the mobile communications network 13 can operate as a workstation in the learning system configured around the LAN 8.

The computers (workstations 1 to 3, 11 and the server 4) can be any standard computers which are powerful enough to run the operating sys-

tem, the applications, and the tasks they are normally dedicated to. The mobile station 12 may be a mobile station connected to a computer, a pocket computer (PAD), a communicator, etc. More generally, the workstation can be implemented by any personal computing device, a portable personal computing device, or a portable personal electronic device having computing capabilities and mobile communication integration.

In the preferred embodiment of the invention, software installed in the workstations is divided into three separate software components: tutor, client and crossroad applications. The component chosen for installation depends on how the specific computer is being used. It should be appreciated that this configuration of the software is described only for illustrative purposes.

The teacher uses the tutor component which is the main interface to the learning system. As used herein, the term teacher or tutor refers to any person who is managing and organizing the learning sessions, i.e. working as a pedagogue. With the tutor component, the teacher can control the student computers, their software and the way they are used. The client software components reside on the workstations 2, 3 and 11 used by the students. After the client components have been installed in the workstations, and the system is up and running, the client component responds to the command sent by the tutor component. The crossroad component 13 is a server application that manages connections between student workstations 2 and 3 and the tutor workstation 1. The crossroad component 13 can be installed in the tutor computer 11 in association with a tutor component, or in a separate server computer, as in the example shown in Figure 1. The tutor component and the client components connect to the crossroad component (server program) and all system control data is passed through the crossroad. The crossroad component also enables two-way communication between the clients and the tutor. The connections between the tutor and the clients may be, for example, TCP/IP connections tunnelled via the crossroad software.

After the computer software has been installed on the required computers, the teacher can start creating the working environment. This means setting up a layout of the student workstations and specifying the software that the students will use in their assignments. The environment created forms a portfolio which can be saved as a working environment. When the basic portfolio has been set up, the teachers can add their own documents to

their portfolios. Portfolios can be modified when necessary, and teachers can have a different portfolio for each class. Each teacher can access his or her own system profile quickly by loading the portfolio.

5 Portfolios are used for storing the unique working environment that has been created separately by or for each teacher, and furthermore, for each lesson. Therefore, a portfolio can also be considered as an electronic lesson plan. Each portfolio may contain a layout of the student workstations, a set of program operations needed for assignments, and a set of documents which the teacher adds to a document list. The user can modify his portfolio(s) to
10 meet his or her changing needs. When the basic portfolio has been set up, the user can change the workstation layout, the application suit, and the documents. The user can save his portfolio(s) in the files for later use. Furthermore, the user can export a portfolio, and then open it for students.

The applications, the documents and the lesson plan in a portfolio
15 can be made available for students. The export saves the applications and documents in a folder as links to the corresponding files. The application shortcuts refer to files on a local computer and document shortcuts to files on a shared resource, such as the learning material database 6 in Figure 1. The portfolio can also contain web sites (i.e. links to web pages). The teacher can
20 add and remove documents and web sites to/from the portfolio. This way, the teacher can provide the students with all the necessary tools and material for a specific lesson. In association with the student software component (as well as in association with the tutor software component) there are means for using the digital material, such as web browser, media player, etc.

25 The present invention provides a new easy-to-use and flexible way to import new learning material to such a learning system, or to any networked learning environment. More particularly, the present invention provides an automated way to produce digital learning material from the digital content of digital television broadcasts. New digital television broadcast networks have
30 been developed all over the world for delivery of television (and also radio) broadcasts. The digital television broadcasting is often called digital video broadcasting (DVB). In the DVB system, digital video coding standards produced by MPEG (Moving Picture Expert Group) are used for source coding and multiplexing audiovisual signals. The current standards are referred to as
35 MPEG-1 to MPEG-4, the currently most often implemented standard being MPEG-2. Therefore, digital MPEG video and audio information is broadcasted

by the DVB system to the customers. However, although these networks are mainly responsible for radio and television broadcast, they can also be used for transmitting different data services to clients. Examples of data broadcasting include downloading software via satellite, cable or terrestrial links, transmitting Internet services via broadcast channels (IP tunneling), interactive television and other interactive services. The digital content may include an electronic program guide and other data, such as video/audio clips, software programs, web pages, etc. The interactive services require that the terminal also comprises means for transmitting data on a return channel to a broadcast network.

In the DVB system, the digital television broadcast is received by an integrated receiver decoder (IRD) which is a device containing a tuner converting the electromagnetic radio frequency broadcast signal to a bit stream and necessary decoders (such as a MPEG decoder) which convert the received bit stream into a format compatible with a television set. Presently, conventional analog television sets are employed for receiving also digital television broadcasts with a special discrete device which implements the IRD and which is often called set-top box (STB). The STB converts the received digital video and audio information into an analog video and audio signal compatible with conventional analog television sets. An example of the set-top box is Media Master from Nokia. Presently, there are also digital television (DVB) receiver cards which can be installed in personal computers (PC) or laptops, so that the user can use the PC for viewing TV programs.

Referring to Figure 1, a DVB reception unit 7 is provided and connected to the local area network (LAN) 8 of the learning system. The reception unit shown in Figure 1 includes a DVB tuner/receiver 71 which receives the DVB broadcast 16 from the satellite, cable or terrestrial broadcasting system 15 and outputs an MPEG-2 stream. In the preferred embodiment of the invention, the DVB receiver (IRD) 71 is implemented by a digital television board installed on a standard personal computer device. The DVB receiver 71 may alternatively be implemented by a separate IRD device (set-top box) which is connected to a personal computer. The receiver unit 7 may further comprise a mass memory 73, such as a hard disc, for recording a received DVB stream or program temporarily. The reception and operation of the DVB receiver 71 and the recording to the mass memory 73 (or to other memory in the LAN 8) are controlled and scheduled by the control software 72 running on a computer.

The control software 72 is also responsible for the communication with the tutor workstation 1 (and possibly other workstations) over the LAN 8. The tutor software component in the tutor workstation 1 is provided with a software tool that enables the teacher to remote control the control software 72 and thereby the DVB receiver unit 7 over the LAN. When the teacher wants to record a specific content from the DVB broadcast for subsequent use as learning material, he/she uses the user interface of the tutor software to configure and schedule the control software 72 to receive and record the specific content. In accordance with this configuration, the control software 72 then configures and schedules the DVB receiver 71 to receive the specific content and to deliver it to the mass memory 73 under the control of the control software 72. Alternatively, the DVB transport stream from the selected broadcast channel can be delivered to the control software 72 which then analyzes the DVB stream and detects the desired content by means of the control information contained in the stream, and captures and records the desired contents to the mass memory 73. Such control information contained in the DVB stream includes the program service information (PSI) and packet identification code (PID), etc., which can be used for this purpose. One feature of the DVB is the electronic program guide (EPG) which can also be used for scheduling and controlling the reception and recording.

The digital content received in the DVB broadcast may have several appearances. In a traditional context, the digital content is purely audio and video, such as films, news or soap operas. As noted above, digital television technology allows service providers to send another digital information syntax using the same delivery channel. The other syntax might include multimedia applications, interactive services related to traditional TV programs or just any information in digital format.

The teacher can schedule the reception and storage to be carried out at any time the desired content is broadcast. For example, the teacher may perform the necessary scheduling operations at daytime, and the DVB receiver unit 7 automatically receives and records the predetermined content in the night. As the content is temporarily recorded to a mass memory (such as 73) or database (such as database 6) accessible from the LAN 8, the teacher can at any subsequent time (e.g. on next day) access and process the recorded digital content of the LAN by his/her tutor software component run on the tutor workstation 1. This processing typically includes categorizing or clas-

sifying content in such a way that the end-users (students) can easily search for and find the appropriate content at the time needed. In the categorizing process, the content is categorized for easy search and use for targeted purposes. In the preferred embodiment of the invention, the categorizing creates
5 "metadata", a description of what the content is about, which the location in the mass storage is, etc. The processed content and the metadata are then stored in the learning material database 6.

After the classified digital content has been stored in the learning material database 6, the teacher can add the content as a link to a lesson
10 portfolio and use the content as any other digital learning material content stored in the database 6 or in another memory in the LAN 8. Thus, the material is available for the students through the portfolios. The stored digital content is available also for other teachers (or other users having direct access rights to the material in the database 6) searching for material for their lessons. When searching the database 6, the metadata associated with the digital content facilitates the search process and especially the evaluation of the
15 content of the digital material, since the content can be evaluated on the basis of the metadata, and viewing or playing the content is not necessary in the first place.

The receiver unit 7 may also be provided with a return channel 17
20 via a suitable telecommunications network 18 for utilization of the interactive services available and relating to the DVB broadcasts. Also various conditional access (CA) features available in the IRD devices can be utilized in the present invention for reception of encrypted content and/or content requiring sub-
25 scription or authorization.

The description of the preferred embodiments is made only to illustrate the invention. The invention is not intended to be restricted to these examples but modifications and changes can be made without departing from the scope and spirit of the attached claims.

Claims

1. A networked learning system comprising a tutor workstation (1) and student workstations (2,3), at least one digital learning material database, and a local area network (8) interconnecting said workstations and said digital learning material database (6), characterized in that said system further comprises
- means (7) for receiving digital television broadcast over a television broadcast system (15) and for storing a selected digital content from said received digital television content in a suitable digital format in a memory means (7, 6) accessible from said local area network (8),
- a program tool run on said tutor workstation (1) for scheduling said receiving and storing means (7) to receive and store said selected digital content,
- a program tool in said tutor workstation (1) for processing said selected digital content into a digital learning material format and for storing said processed digital content in said digital learning material database (6),
- student applications run on said student workstations (2,3) for accessing and using said processed digital content in said digital learning material database (6) during learning sessions.
2. A system as claimed in claim 1, characterized in that said processing program tool includes means for categorizing said selected digital content.
3. A system as claimed in claim 1 or 2, characterized in that said processing program tool includes means for categorizing said selected digital content, said categorizing including creating metadata describing said digital content.
4. A system as claimed in claim 1 or 2, characterized in that said processing program tool includes means for inserting said processed digital content as a link to a digital portfolio which defines a working environment for a lesson.
5. A method in a tutor workstation in a networked learning system comprising a tutor workstation and student workstations, at least one digital learning material database, and a local area network interconnecting said workstations and said digital learning material database, characterized by said method comprising

scheduling by means of said tutor workstation over said local area network, reception and storage of a selected digital content from a digital television broadcast received from a television broadcast system,

5 processing said selected digital content into a digital learning material format,

 storing said processed digital content in said digital learning material database.

6. A method as claimed in claim 5, characterized by
10 said processing step comprising means for categorizing said selected digital content.

7. A method as claimed in claim 5 or 6, characterized in that
 said processing comprises categorizing said selected digital content.

8. A method as claimed in claim 7, characterized in that said
15 categorizing comprises creating metadata describing said digital content.

9. A method as claimed in claim 5, 6, 7 or 8, characterized in that

 said processing comprises inserting said processed digital content as a link to a digital portfolio which defines a working environment for a lesson.

20 10. A computer program product comprising program code means stored in a computer readable medium for performing the method of any one of claims 5 to 9 when the program is run on a computer.

11. A computer program comprising code means for performing all the steps of any one of claims 5 to 9 when the program is run on a computer.

25 12. A receiver device in a networked learning system comprising a tutor workstation (1) and student workstations (2,3), at least one digital learning material database (6), and a local area network (8) interconnecting said workstations and said digital learning material database, characterized in that

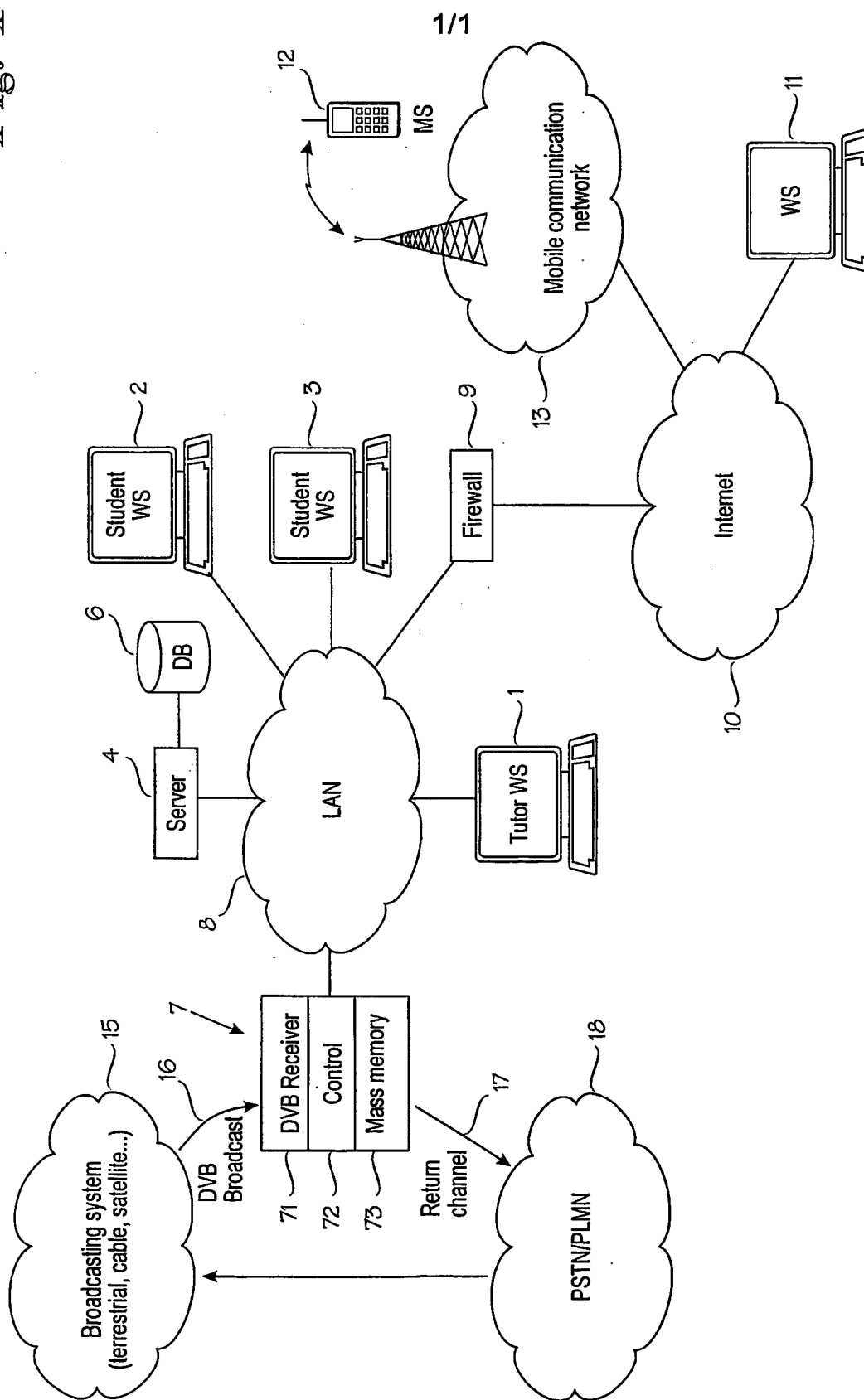
30 said receiver device (7) is connected to said local area network and comprises digital television receiver means (71) for receiving digital television broadcast over a television broadcast system (15) and for storing a selected digital content from said received digital television content in a suitable digital format in a memory means (73) accessible from said local area network,

35 said receiver device (7) comprising scheduling means (72) controllable by said tutor workstation (1) over said local area network (8) for schedul-

ing said receiving and storing means (71) to receive and store a selected digital content.

13. A device as claimed in claim 12, characterized in that said receiver device is a server computer provided with a digital television receiver
5 card.

Fig. 1



INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 02/00960

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: G09B 5/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: G09B, G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X	US 2001037376 A1 (ULLMAN, C. ET AL), 1 November 2001 (01.11.01), page 3, [0031]-[0032]; page 5, [0056]; page 6, [0060]-[0061], figure 4, abstract --	1-13
A	US 6149441 A (PELLEGRINO, J.E.), 21 November 2000 (21.11.00), column 2, line 31 - column 4, line 4, abstract --	1-13

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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Date of the actual completion of the international search

Date of mailing of the international search report

18 February 2003

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 02/00960

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	WO 9727572 A1 (GUY, F.), 31 July 1997 (31.07.97), page 4, line 19 - page 5, line 9, figure 1, claims 1,8,12, abstract -- -----	1-13

INTERNATIONAL SEARCH REPORT

Information on patent family members

30/12/02

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